Strategy Research Project

STRENGTHENING THE SCIENTIFIC CAPACITY AVAILABLE TO SERVE THE NATION

BY

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USAWC STRATEGY RESEARCH PROJECT

STRENGTHENING THE SCIENTIFIC CAPACITY AVAILABLE TO SERVE THE NATION

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ABSTRACT

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At a time when science and technology continues to play an ever-increasing role in transforming society and warfare, the numbers of scientists and engineers graduating from US colleges and universities nationwide continues to decline. The question this Strategic Research Project will attempt to answer is what the Army, industry, and the nation can do to promote and encourage larger numbers of US youth to pursue technical degrees. This paper examines: 1) immigration reform, 2) instituting new scholarship programs and eliminating barriers in others, 3) collaborating with schools and establishing military active pages, 4) funding the brightest science teachers to conduct research at Army research facilities, 5) establishing a strategic communications plan, 6) sponsoring traveling science programs and establishing science fairs, 7) establishing technical courses, 8) changing the new Post 9/11 GI Bill, and 9) leveraging industry.

STRENGTHENING THE SCIENTIFIC CAPACITY AVAILABLE TO SERVE THE NATION

At a time when science and technology continues to play an ever-increasing role in transforming society and warfare, the numbers of scientists and engineers graduating from US colleges and universities nationwide continues to decline.[1] Interestingly, two of the US' technological competitors, China and India, graduated approximately 500,000 and 200,000 engineers, respectively in 2004, compared to just 70,000 in the United States (US)[2]. The question this Strategic Research Project will attempt to answer is what the Army, industry, and the nation can do to promote and encourage larger numbers of US youth to pursue technical degrees. This paper examines: 1) immigration reform 2) instituting new scholarship programs and eliminating barriers in others, 3) collaborating with schools and establishing military active pages, 4) funding the brightest science teachers to conduct research at Army research facilities, 5) establishing a strategic communications plan, 6) sponsoring traveling science programs and establishing science fairs, 7) establishing technical courses, 8) changing the new Post 9/11 GI Bill, and 9) leveraging industry.

Problem

Strengthening America's scientific and engineering capacity is critical to ensuring a highly skilled work force within the US that can drive technological advances. "Economists attribute a significant portion of the extraordinary boom in productivity during the 1990's to technological innovation."[3] In 2001, then Federal Reserve Board Chairman, Alan Greenspan cited innovation as the reason for significant gains in productivity growth since 1995. Mr. Greenspan told Congress: "Had the innovations of

recent decades, especially in information technologies, not come to fruition, productivity growth…would have continued to languish at the rate of the preceding twenty years."[4] The US economy will suffer a significant down turn and our national security will suffer if state of the art technology is not developed, accessed, and adopted within our borders. The US' "level of technological achievement generally will be defined in terms of its investment in integrating and applying the new, globally available technologies – whether the technologies are acquired through a country's own basic research or from technology leaders."[5] Additionally, our national security will suffer if our economy cannot sustain the best military force in the world. The key to US economic growth is technology development. "It is no wondered that economist Edwin Mansfield calculated as much as a 40 percent return for the federal investment in basic university-based research."[6] Further, a strong military requires a strong economy. There are intrinsic reasons for increasing our scientific and engineering capacity other than driving the economy to sustain a powerful military. For instance, technological advances within the DOD often result in "spin-off" technological applications in the private sector that further fuel the economy.

Many experts agree that the US will retain its edge across all the dimensions of power through 2020. Still, the US visualizes the closing technology gap with China, India, and others as evidence of its relative power position eroding.[7] Staying ahead of our adversaries in technology, not only helps to keep the military strong, it also acts as a psychological deterrent to other nations, which helps thwart any consideration our adversaries may have to engage the US in military conflict. This is because, the intellectual brainpower needed, the actual development of technology, and the vast

economic resources required of a competitive country to close the military capabilities gap with the US are daunting and costly. To ensure it maintains this technological edge, the US must feed the technological furnace with the brightest and best-educated individuals available.

Solution

How does the US acquire the brightest and best-educated individuals in the world? There are only two options for the US: 1) attract the best minds from around the world or 2) educate them ourselves, within the population of the US.

Immigration Reform. Many bright young people in the US today are immigrants or from immigrant families. From the author's private industrial experience in research and development, many technology driven companies specifically sift through resumes looking for personnel educated in leading research universities from around the world. For example, many hiring managers consider Peking University as one of the best research universities in the world, ranked 14th in 2006.[8] The US must dramatically increase efforts in searching out the brightest students from around the globe, bring them to the US, and then keep them here.

To attract the brightest and best-educated individuals from around the world the US must institute less restrictive immigration policies for technical people. Many of the best foreign students from around the world already come to the US for their advanced education. The US must seek to ensure that many of the brightest foreign students desire to stay by providing them better opportunities within the US than in their own country. The US can streamline the citizenship process for the brightest foreign students just as the US does for US military members who are not citizens. Currently,

US military members in support of Operation Iraqi Freedom and Operation Enduring Freedom hail from 52 different countries.[9] Thousands of immigrant troops have made, and are making extraordinary sacrifices for the US. Recent policy has streamlined the citizenship process for service members in combat zones.[10] We should extend this streamlined citizenship process to those individuals that can strengthen our nation's scientific and engineering capacity as well. The immigrant troops are eligible to file for immediate citizenship under the special wartime provisions in the Immigration and Nationality Act.[11] Likewise, we should enable those individuals who can strengthen our nation's scientific and engineering capacity with a similar process under a special scientific and engineering capacity provision in the Immigration and Nationality Act.

Increasing the Number of Technical Students. Increasing the number of US students that pursue technical degrees is perhaps a harder task. First, the Army should use the General Educational Development (GED) testing battery to identify technically promising individuals who did not complete high school. Second, the Army should collaborate with schools to capture the imagination of young children by making science exciting, relevant, and accessible. Third, fund the brightest science teachers and their students to conduct research at Army research facilities. Fourth, the Army should establish a strategic communications plan. Fifth, the Army should sponsor traveling science programs and help establish science fairs. Sixth, Army scientists should collaborate through military active pages on class web pages. Seventh, the Army should establish yearlong technical courses on school premises. Eighth, the Army should eliminate existing barriers in the ROTC program. Finally, ninth, the Army should work with Congress to ease rules and regulations in the new Post 9/11 GI Bill.

Discussion and Recommendations

GED. When students fail to complete high school, individuals often resort to the GED, a certification that some employers consider less worthy or lower than a high-school diploma. Interestingly, one service, the Air Force will not even allow a GED graduate into their service; the Air Force requires a high-school diploma.

The original concept of the GED program was great. It was created to help WWII veterans integrate smoothly back into civilian life. Many now say the GED program is a crutch to the failing educational system but there is a positive aspect. It provides a testing service to those who choose to home school their children and to those that immigrate to the US. A number of states award scholarships to the highest scoring GED individuals to help them pursue post-secondary education. The military could put in place their own academic scholarships that capture individuals that score highly on the science portion and meet certain standards on the remaining four GED test areas (e.g., Writing, Reading, Social Studies, and Mathematics). This would allow the military to tap into the scientific cream of the crop amongst the millions that have received GED diplomas. Concentrating on the highest scoring individuals on the GED science test will reduce potential attrition rates in post secondary education.

Making Science Exciting. Fortunately, we have inspiring teachers within our scientific educational system that are currently making an enormous contribution to increasing our scientific capacity. One such individual is Mr. Warren Phillips, a seventh-grade science teacher at Plymouth Community Intermediate School (PCIS) located in Plymouth, Massachusetts. Mr. Phillips has many educational awards to include Disney's Outstanding Middle School Teacher in 2004 and TIME for Kids magazine's Teacher of the Year in 2002.[12] Although, Mr. Phillips does not track how many of his

students go on to pursue careers in the technical or scientific arena, he was able to name four former students that are science teachers and a fifth that is his principal: a great testament to his professional skills as an educator.[13]

Mr. Phillips has adapted the JASON Project as part of his science curriculum. The JASON Project is a nonprofit subsidiary of the National Geographic Society that connects young students with great explorers and grand events to inspire and motivate them to learn science.[14] The project's curriculum is for fifth-through eighth-grade classrooms, but is easily adapted to other grades as well.[15] The JASON Project is a student's gateway to science adventure. For instance, Mr. Phillips' students venture around the world via an interactive website and familiarize themselves with the staff of scientists associated with the JASON Project adventure. Students are required to adopt a specific online scientist of their choosing and write about that particular scientist's interests and create a short biography of the scientist.[16] Students not only study their local environment, but also compare it to another part of the world; developing a global perspective of the issues challenging our global environments. In addition, to enhance the unique learning experience provided by the JASON Project, the PCIS team utilizes theme-based learning and a multidisciplinary curriculum involving real science studies.[17] The JASON Project includes an interactive website, live broadcasts, curriculum, teacher's guide, videos, and many other resources.[18] The PCIS team incorporates brain-based learning which provides their students with unforgettable learning experiences.[19] Brain-based learning targets the structure and function of the brain. It revolves around the notion that everyone learns in ways that are best suited for themselves. One of the best-known authors of brain-based learning is Dr. Marcia Tate.

Dr. Tate is the former Executive Director of Professional Development for the DeKalb County School System, Decatur, Georgia and is currently a National Educational Consultant.[20] Mr. Phillips is a Dr. Tate fan and encourages others to engage students with her brain-based learning strategies.[21] These types of strategies suggest that students do not optimally learn using traditional methods of instruction (e.g., worksheets, sterile environments, bright lights, et cetera) but need to be actively engaged in their own learning and that is what Mr. Phillips brings to his classroom, hands-on techniques that help students learn in more motivating and engaging ways.

In 2005, the JASON Project traveled to the Panamanian rainforest and Mr. Phillips introduced his class to the project by reading *The Great Kapok Tree.*[22] Mr. Phillips had his students compare the rainforest in Panama with their local forest in Plymouth and discussions and debate centered on the value of using the rainforest's resources or preserving them for the future.[23] Each student created a JASON Journal to keep field notes, measurements, reflections, drawings, and test results.[24] An additional student requirement for the JASON Journal was to create an informative fact-filled cover about the project.[25]

Mr. Phillips' students then constructed a web page and populated it with rainforest and Plymouth vernal pool animals, scientific names, fun facts, habitats, bibliographies, original drawings, and background information that other JASON Project students from across the country could access.[26] The teachers and students replicated a rainforest in a large hallway utilizing many after-school sessions where trees were constructed from carpet tubes, a river was made out of blue paper, et cetera.[27]

In preparation for a field trip to a local pond mini-lab, stations were set up around the room to determine sediment analysis, weather conditions, temperature, water clarity, density, salinity, pH levels, current speed, dissolved oxygen, and invertebrate populations.[28] Students entered the lab data into their JASON Journals and then conducted the experiments again at the local pond during their field trip.[29] This science project was a multidisciplinary curriculum utilizing real-world science studies where the language arts teacher conducted a writing reflection; the geography teacher used Global Positioning System (GPS) to determine their location; the math teacher determined the slope of the beach; and the reading teacher conducted a scavenger hunt for species using a field guide.[30] To everyone involved, this was team teaching and experiential learning at its finest.[31]

Mr. Phillips' classes are a perfect example of how today's technology brings science to life. Mr. Phillips used the JASON Project to bring the rainforests of Panama to life for his students and compared it to the local town forest that surrounds PCIS. Next, Mr. Phillips' class used the JASON Project to compare the Panama Canal to the Cape Cod Canal, just a half hour bus ride from his classrooms. Mr. Phillips coordinated a field trip that included a cruise from one end of the Cape Cod Canal in Buzzard's Bay to the other end in Cape Cod Bay. Mr. Phillips' class studied the history, technology, and significance of both canals to world travel. The curriculum allows students to interact with one another in a classroom setting and to work at their own pace with the interactive website.

To capture the students' hearts and minds with technology, Mr. Phillips turned to the television (TV) studio located in PCIS and his expertise as a TV Technology

teacher.[32] He trained a student crew to operate the TV studio and they frequently interview guests, like the Rangers that work the Cape Cod Canal.[33] The interviews include a question-and-answer session with a live student audience and include Public Science Lessons (PSLs) commercials created by students from previous-summer camp sessions.[34] Upon completion, the students transmitted the production on a local cable channel reaching an estimated 40,000 households in Plymouth, which accomplishes three things: 1) it educates the students, 2) it educates the public, and 3) it is a great public-relations tool for the school.[35]

By revolving a portion of the PCIS science curriculum around the JASON Program, Mr. Phillips and his colleagues were able to access additional resources and produce an increased interest in science and technology. Adapting the JASON Project appears to give young students a real flavor of what a career in science would entail. The students learn to ask and answer scientific questions by making observations and conducting experiments. They create a journal, conduct background research, propose a hypothesis, test their hypothesis by conducting investigations over time instead of just in a single science period, gather and analyze data, draw conclusions by proving or disapproving their hypothesis, and finally, report their results. Mr. Phillips' students are not simply taking a science course; they are living it. Mr. Phillips' enthusiasm for teaching science and his wide range of teaching tools affords his students an unforgettable experience.

An energetic, experienced individual with such devotion to teaching children as Mr. Phillips has demonstrated over his career would be a great find for the DA. The Army must consider incorporating teaching techniques like the ones used by Mr. Phillips

into an Outreach Program that would utilize: 1) unique learning experiences like the JASON Project, 2) theme-based learning, 3) a multidisciplinary curriculum, and 4) brain-based learning strategies.

To recruit and retain energetic, experienced science teachers, like Mr. Phillips, that will provide lasting impressions on school age children the educational system needs to compensate them appropriately. There are two major reasons why math and science teachers are in such high demand: 1) the US does not produce enough and 2) those the US does produce find better-paying jobs outside of teaching. For example, the average industrial chemist with a bachelor's degree and less than five years of experience earns approximately$46.9K per year.[36] While the average high school teacher with a bachelor's degree in chemistry and less than five years of experience earns approximately $37.4K per year.[37] This explains why the US educational system has only 41 percent of eighth-grade students receiving mathematics instruction from teachers who specialize in mathematics, the international average is 71 percent.[38] As a result, less than one-third of US fourth- and eighth-grade students perform at or above the proficient level in mathematics.[39]

Treat Science Teachers Like Professors. Money is extremely important but it is not the total answer to recruiting and retaining highly qualified math and science teachers. The Army should offer the brightest science teachers the opportunity to conduct research at US Army Research facilities. The Army must fund these high quality science teachers through the summer. The Army must allow teachers to bring the top science students from their school system to assist in the research as well. The Army should fund the top science teachers to attend conferences in technological areas

that stimulate their research and teaching interests so they return to their classes with more thought provoking way to stimulate their students.

Establish a Strategic Communications Plan. The Army must establish a strategic communications plan to communicate to the public and to political leaders the value of properly educating future technical professionals. The *Sputnik* launch led to education reform in the 1950s and federal programs were set up to recruit high school students to become science and engineering majors.[40] The educational reform developed: 1) innovative ways of teaching science and mathematics, 2) new educational materials, 3) federally funded workshops, and 4) mentorship programs where senior scientists, mathematicians, and engineers worked with teachers and other educators.[41] During the *Sputnik* era, student achievement scores on science exams rose after the reform.[42] The country cannot wait for another *Sputnik* to shock the average citizen and the government back into action.[43]

Army Support to School Systems. A common theme of the educators and administrators (e.g., teachers, principals, and presidents) interviewed in this paper was funding.[44] Whether it is a shortage of microscopes, old science textbooks or a broken weather station in the science laboratory, funding is just not available to fix or replace everything. The Army should support school systems with excess scientific equipment bound for the Defense Reutilization and Marketing Offices (DRMO) and provide a mechanism to provide funding when a school system lacks the resources to purchase new scientific books. In addition, all educators interviewed agreed that the military could stimulate scientific study by sponsoring a traveling science program.[45] The program

could range in duration from a few hours during the school day, a weekend, or even a science camp conducted over the summer months.

Accessing dedicated scientists of all sister services to create a traveling science program could greatly affect our nation's scientific capacity. To accentuate the point, many of the educators interviewed agreed that their school's science expositions were not captivating enough for kids.[46] Instituting a mentorship program with military researchers could address the students' lack of interest. A traveling science program could offer any type of instruction, limited only by one's imagination.

Many of today's military scientists already participate in local, regional, national, and international science fairs as judges. For instance, Wright-Patterson Air Force Base has a great Outreach Program that sends many Air Force employees throughout the local Dayton, Ohio area to participate in educational science fairs.[47] These military scientists have the desire to help young students experience a science fair. For those students that may seem a little inhibited or afraid of such an undertaking, the initial step might entail attending a science fair with a science teacher or mentor and exploring the many exciting and creative displays that are available to capture the imagination. Students could then write a report on their favorite exhibit. A science fair would inspire these young scientists, especially when an exhibitor, a school aged student, like themselves, explains the science project to them first hand. This type of event might encourage younger students to submit projects in future science fairs. This approach would strengthen existing science programs and stimulate many future scientists. Parents, teachers, religious figures, political leaders, and military personnel could bring

traveling science programs or science fairs to schools and help nurture curiosity in science by glorifying those who choose to embrace it.

A perfect example of glorifying those who choose to embrace the sciences is in the December 2008 issue of Discovery.[48] The article, “Best Brains in Science 2008,” brought to light the scientific achievements of numerous individuals across many categories of science. The magazine highlighted: 1) the 20 best scientists under 40 years of age, 2) the life time achievers, 3) the five best scientists under 20 years of age, and finally, 4) the non scientists (or “outsiders”) and influential people who match wits with professionals and set the agenda, respectively.[49] Impressively, the magazine had a face-to-face with Dr. Stephen Hawking at the University of Cambridge. Dr. Hawking is writing a series of children’s science books promoting dialogue between science and religion, and calling attention to the greatest threats to human survival.[50] Finally, society must find ways of integrating those individuals that public schools are not well suited for, back into the educational system, something that cannot occur in the absence of great mentoring and economic opportunity.

If Army scientists could collaborate through a military active page on class web pages, which many schools already have, then science teachers and students could have their own science mentor right in their classroom. Science students throughout the country could contact their own online mentor by email or depending on technology assets available conduct a teleconference of videoconference. Active pages could bring the military’s best scientists to life in science classrooms across the country. The online military scientist could invigorate the science classes with thought-provoking questions and answers. Finally, the military scientist could mentor students through various

science projects. This would be a simple way to coordinate a traveling summer science camp or science fair with the teachers around the country.

One Principal stated, “The military could better strengthen the scientific and engineering capacity available to serve the Army and the nation by taking an approach similar to that of industry.”[51] For example, in the field of robotics, industry has collaborated with a number of high schools to develop yearlong robotics courses to motivate students to pursue technical fields of study in college. Some of the partnerships between industry and academia result in nationwide interscholastic competitions.

This same Principal made the point that students wish to put into practical use what they learn in the classroom. For example, the math classes in his school use data from the school’s solar panels for practical applications. The Principal, also mentioned that Boston University has a traveling biological van to stimulate students’ motivation with science, but there is nothing he is aware of involving physics and only a small amount of effort in the area of chemistry. This is one of the reasons that this long-time educator asserted that a qualified military mentor for a particular school was a wonderful idea indeed.

To enlighten these young minds the military could become intimately involved with a school’s science curriculum in a number of ways. First, the military could assign a mentor to a particular school so both the mentor and the school could learn one another’s strengths and weaknesses and eventually develop a curriculum that draws on the strengths of each. Second, the military could develop a program of adjunct military scientists to enhance a school’s science curriculum. The military scientist could support

electives that focus on the practical use of knowledge derived from studying such courses as civil engineering, mechanical engineering, electrical engineering, aeronautical engineering, polymer chemistry, organic chemistry, physics, computer science, et cetera.

Different categories of military personnel could support the initiative to strengthen the scientific capacity available to serve the nation. First, there are service members that reach Mandatory Retirement Date (MRD) that have the proper credentials to become adjunct military scientists, and desire to remain in the military. This category of personnel includes not only Active Component personnel but also Reserve Component personnel. The Army should allow MRD officers that have technical degrees and the motivation to remain in the military to serve as adjunct professors and mentors. If the Army wants to promote and encourage larger numbers of America's youth to pursue technical degrees, laws have to change to allow qualified service members to remain on active duty.

One way to organize and staff an Army effort in this area, whether or not there is success in the MRD or recall to active duty initiative, is to establish units similar to the Total Army School System (TASS) battalions.[52] Units would be comprised of accredited and integrated Active Army, Army National Guard, and Army Reserve schools that provide standard scientific training and education for the nation's school systems. The curriculum would include establishing science fairs, providing science camps, establishing highly technical, hands on elective courses, et cetera.

For a Reserve Component Soldier their 48 Battle Assemblies and two weeks Annual Training could be in support of such a program. The Army should consider

granting scientists one-year sabbaticals to become adjunct professors or mentors in the secondary school system. They could have a traveling exhibit, which would travel from school-to-school with a one day, or weeklong exhibit exposing the schoolchildren from around the country to the exceptional research projects in today's military. Opening the eyes of these young potential scientists could show them the great opportunities that exist in pursuing a technical career in the military and in the civilian world.

Eliminate Existing Barriers in ROTC and new Post 9/11 GI Bill. The Army needs to eliminate two barriers for highly motivated enlisted personnel to pursue technical degrees within the "Green to Gold Program". First, qualifying enlisted members from a sister service should not have to overcome discharge barriers for an ROTC scholarship in another service's program. Currently, service members of sister services are not eligible for the "Green to Gold Program" if they have not completed their service contract."[53] Commissioning Soldiers, Marines, Airmen, and Sailors with technical acumen should be a priority for all of DOD and the services should not stand in each other's way. Second, according to Cadet Command Regulation 9a, ROTC scholarship winners who leave the program for any reason are ineligible to re-compete.[54] The flaw in this policy is there are numerous reasons why a former ROTC scholarship recipient might leave the program. Therefore, allowing qualified individuals who left the program for extenuating circumstances to re-compete is simply good policy.

In accordance with a viable educational system, sharing the new Post 9/11 GI Bill benefits with family members is an exemplary project.[55] However, to promote and encourage larger numbers of America's youth to pursue technical degrees, Congress must ease their rules and regulations as it applies to children of service members that

pursue such degrees. Make the pursuit of a technical degree the trump card. If a service member's child pursues a technical degree, the Veterans Administration (VA): 1) should revise their definition of family members to include married children, 2) include children of retirees, 3) waive the 10 year service restriction, 4) waive the 36 month college benefit limitation for families with multiple children, 5) pay 100 percent of the college tuition (to include housing, books, and supplies) regardless of how many months of active duty the service member has acquired since 9/11, and pay full tuition reimbursement for people attending private schools, not just public institutions. This type of educational package will send the correct incentive message for recruiting and retention and will increase the numbers of scientists and engineers that graduate from colleges and universities nationwide.

The VA is taking the appropriate steps, so people who are eligible for educational benefits under the new Post 9/11 GI Bill can attend private schools. The VA initiative is the "Yellow Ribbon Program."[56] This program addresses those instances where tuition and fees at a private school are greater than the maximum rate VA will pay in that state, VA will pay $1 more for every $1 cut the school make in its tuition rate.[57] Hopefully, the VA and private schools can meet in the middle so the student does not bear the burden.

Innovative Approaches in Industry. Private industry also has a responsibility to ensure that the technology pipeline of highly educated people is continual flowing into their organizations. Many organizations make up the shortfall of technically qualified scientist and engineers by farming out the work to other countries. However, some projects in the support of DOD require the work to stay in house for security reasons. Since most companies have a big stake in filling technical positions within their walls,

many are taking very innovative approaches to keeping that pipeline full. For example, Northrop Grumman Corporation (NGC) realized the shortage of technical degrees pursued within the US educational system and has developed a unique approach to fight the declining numbers of scientists and engineers that enter the work force. NGC has instituted a first-of-its-kind educational program, which helps teachers inspire students to pursue technical degrees, which could help fill the vacancies in the field of space exploration.[58] Further, NGC has taken their educational program to several regions throughout the US. Its program has reached many target audiences, to include the 2006 Teachers of the Year and their international counterparts. The program included hands-on science workshops and zero gravity flights. This program gives the nation's best teachers first hand experiences, similar to what US astronauts receive, so they return to their classrooms with more thought-provoking ways to teach and inspire scientifically inclined youth to pursue technical degrees in support of space exploration.

Raytheon Company kicked off an Internet-based, interactive project called "MathMovesU" which incorporates sports celebrities, math problems, and cash.[59] Raytheon's Chairman and Chief Executive Officer (CEO) believe the critical time to reach students with math and science education is fourth- through eighth-grade.[60] MathMovesU glorifies mathematics by having star athletes pose math problems to kids.[61] Raytheon's program has already earned 450 students $1,000 scholarships, paid out $165,000 in grant money to teachers who create more inviting math lesson plans, and the schools where scholarship winners attend also earn $1,000 awards.[62]

The Internet-based project recorded a one-night high login rate of 18,000 kids.[63] MathMovesU uses celebrities like Terry Francona, Boston Red Sox manager, as

substitute math teachers.[64] He demonstrated how he uses mathematics to rate players and plan strategy.[65] Terry Francona told his math class, “From batting averages to a pitcher’s Earned Run Average (ERA), I wouldn’t be where I am today without understanding how math plays into my sport.”[66] Raytheon’s CEO stated that MathMovesU is a very successful program but contributes only a tiny portion to the overall requirement.[67] Everyone needs to share the burden of promoting and encouraging larger numbers of American youths to pursue technical degrees to solve this problem.[68]

Conclusion

This paper identifies numerous areas where the Army, industry, and the nation can have a positive effect in promoting and encouraging larger numbers of American youth to pursue technical degrees. Some of these areas are more direct and have a narrow focus, while others are not. For instance, the areas that fall into the former category may require mere adjustments to current US policy or regulations, like ensuring that the brightest foreign students have a streamlined pathway to US citizenship. This technique is not difficult. DOD already uses it for our US service members that are not yet citizens, but hear the call for duty in far off combat zones around the world. Other examples include: 1) providing academic scholarships to those individuals that score highly on the science portion of the GED, 2) support school systems with excess scientific equipment bound for DRMO, 3) establishing a strategic communications plan to communicate to the public and to political leaders the value of properly educating future technical professionals, and 4) provide funding to financially strapped schools to purchase scientific books. The Army, on its own authority, could

make the following adjustments: 1) allow service members from sister services eligible for the “Green to Gold” program, and 2) allow scholarship winners who leave the program to re-compete.

To promote and encourage larger numbers of US youth to pursue technical degrees Congress needs to ease the Post 9/11 GI Bill rules and regulations as they apply to children of service members that pursue such degrees. If children of service members pursue technical degrees, Congress should: 1) revise their definition of family members to include married children, 2) include children of retirees, 3) waive the 10 year service restriction, 4) waive the 36 month college benefit limitation for families with multiple children, and 5) pay 100 percent of the college tuition, to include housing, books, and supplies regardless of how many months of active duty the service member has acquired since 9/11.

The latter category, the less direct and more broadly focused will take some time to implement fully. The aim is to capture the imagination of America’s scientific youth by making science exciting, relevant, and accessible. The idea is to build a gateway to scientific adventure like the one Mr. Phillips created in his classroom. The Army should consider placing individuals of this caliber and experience under contract to create an Outreach Program that would collaborate with school systems to provide: 1) unique learning experiences like the JASON Project, 2) theme-based learning, 3) a multidisciplinary curriculum, and 4) brain-based learning strategies.

Another branch of this category that drives home the exciting, relevant, and accessible features of this program are traveling science programs that visit schools and that focus on the practicum of what students learn in their classrooms. A different

aspect of this program could have adjunct military instructors that would provide yearlong science and technology courses in their assigned schools, just as industry has done with robotics. Army scientists should collaborate through military active pages on class web pages in order to reach a larger audience. The Army should become more involved in science fairs and provide prize money for the winners and scholarships for those high school winners that continue their education and enroll in an academic curriculum that leads to a technical degree.

The Army needs to follow suit as NGC has done by instituting an educational program, which helps teachers inspire students to pursue technical degrees. The Army should offer the brightest science teachers the opportunity to conduct research at US Army research facilities. The Army should fund these high quality science teachers through the summer. The Army should fund the top science teachers to attend conferences in technological areas that stimulate their research and teaching interests so they return to their classes with more thought provoking way to stimulate their students. This type of program gives America's best teachers first hand science and technology experiences so they return to their classrooms with more thought-provoking ways to teach and inspire our scientifically inclined youth.

The purpose of this research is to stimulate interest in reversing the trend of declining scientists and engineers graduating from America's colleges and universities nationwide. Many potential ideas, large and small, are introduced that may have significant positive impact on this negative trend. Some ideas are simple concepts but still require the cutting of bureaucratic red tape. Others are larger undertakings requiring money, time, and the right individual to champion the particular initiative. These

initiatives could ultimately have profound effects on the future of America's military, economy, and ultimately its National Security.

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